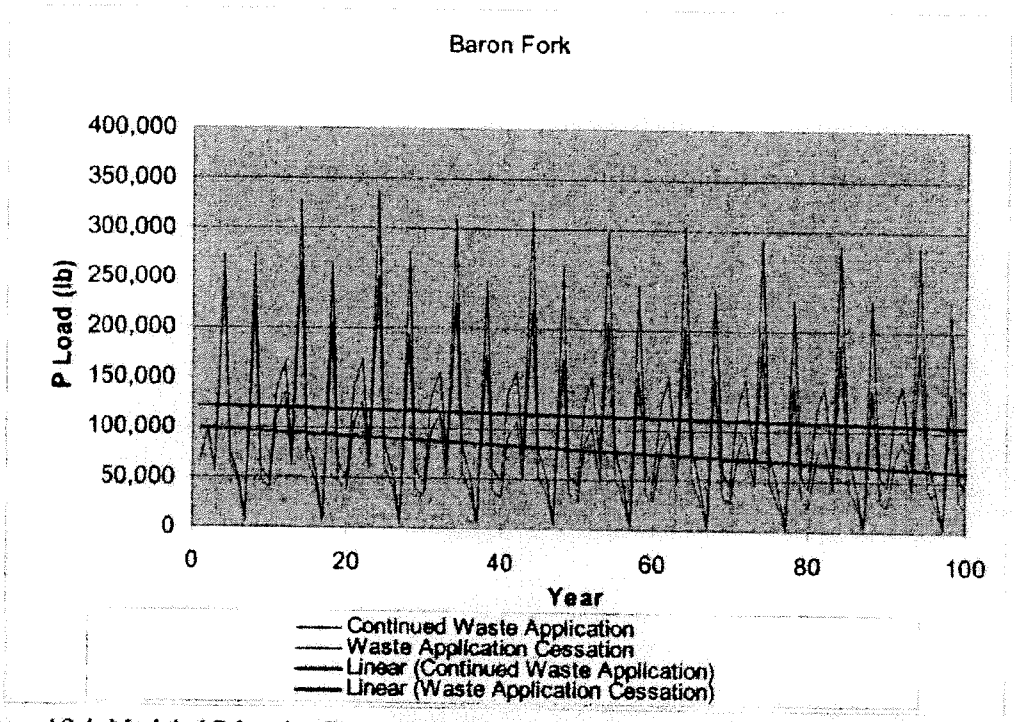

Figure 10.4. Modeled P Load at Baron Fork Gauging Station near Eldon for Continuing Poultry Waste Application and for Cessation of Poultry Waste Application in the IRW

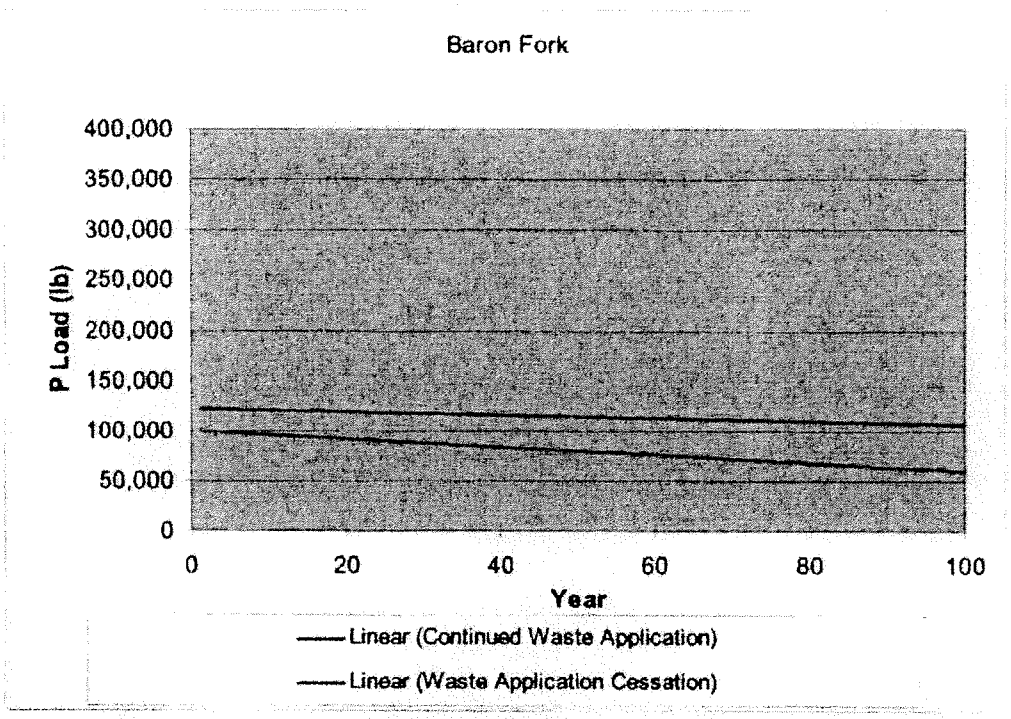

Figure 10.5. Trend Lines for Modeled P Load at Baron Fork Gauging Station Near Eldon for Continuing Poultry Waste Application and for Cessation of Poultry Waste Application in the IRW

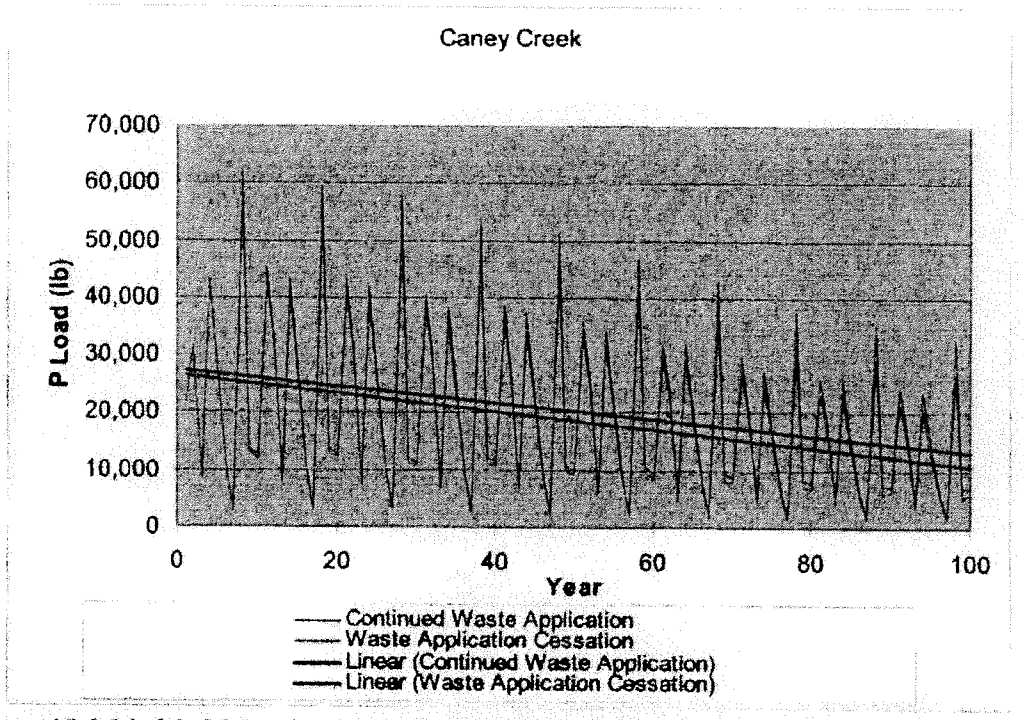

Figure 10.6. Modeled P Load at Caney Creek Gauging Station Near Eldon for Continuing Poultry Waste Application and for Cessation of Poultry Waste Application in the IRW

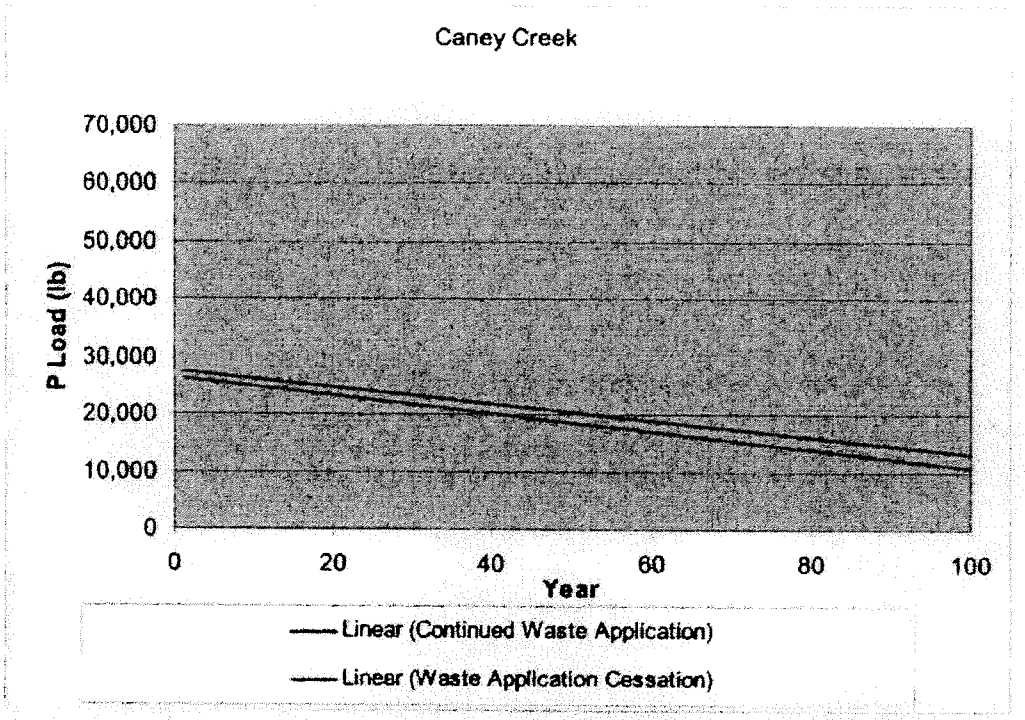

Figure 10.7. Trend Lines for Modeled P Load at Caney Creek Gauging Station near Eldon for Continuing Poultry Waste Application and for Cessation of Poultry Waste Application in the IRW

Table 10.2. Modeled P Loads at Illinois River Gauging Locations for Continued Poultry Waste Application and for Cessation of Waste Application in the IRW. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

	Illinois River at Tahlequah		**Baron Fork**		**Caney Creek**	
Years	P- Continued Waste Application (lb)	P – Cessation of Waste Application (lb)	P- Continued Waste Application (lb)	P – Cessation of Waste Application (lb)	P- Continued Waste Application (lb)	P – Cessation of Waste Application (lb)
1-10	3,927,423	3,216,011	1,012,460	896,907	234,612	230,567
11-20	4,408,574	2,787,287	1,240,857	987,724	258,152	244,926
21-30	4,548,255	2,509,046	1,251,316	919,733	245,572	229,875
31-40	4,479,081	2,264,368	1,175,349	837,203	230,505	214,008
41-50	4,489,549	2,094,246	1,183,206	799,781	217,512	199,793
51-60	4,418,033	1,948,115	1,135,476	761,917	203,549	185,336
61-70	4,401,297	1,831,139	1,136,226	739,856	185,929	166,473
71-80	4,359,942	1,740,937	1,108,147	703,919	163,384	143,812
81-90	4,365,054	1,693,602	1,083,262	675,952	149,368	129,298
91-100	4,384,281	1,657,713	1,078,687	661,290	139,019	118,251

Table 10.3. Change in P Loads to Lake Tenkiller for 10 Year Periods into the Future for Continued Poultry Waste Application and Cessation of Waste Application in the IRW. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

Year	Total P Continued Waste (lb)	Change from Previous 10 Years (%)	Total P Waste Cessation (lb)	Change from Previous 10 Years (%)
1-10	5,174,495		4,343,485	
11-20	5,907,583	14.2	4,019,937	-7.4
21-30	6,045,143	2.3	3,658,654	-9.0
31-40	5,884,935	-2.7	3,315,579	-9.4
41-50	5,890,267	0.1	3,093,820	-6.7
51-60	5,757,058	-2.3	2,895,368	-6.4
61-70	5,723,452	-0.6	2,737,468	-5.5
71-80	5,631,473	-1.6	2,588,668	-5.4
81-90	5,597,684	-0.6	2,498,852	-3.5
91-100	5,601,987	0.1	2,437,254	-2.5

Table 10.4. Difference in P Loads to Tenkiller for Continued Poultry Waste Application Compared to Poultry Waste Application Cessation. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

Year	Total P Continued Waste (lb)	Total P Waste Cessation (lb)	Difference (%)
1-10	5,174,495	4,343,485	16.1
11-20	5,907,583	4,019,937	32.0
21-30	6,045,143	3,658,654	39.5
31-40	5,884,935	3,315,579	43.7
41-50	5,890,267	3,093,820	47.5
51-60	5,757,058	2,895,368	49.7
61-70	5,723,452	2,737,468	52.2
71-80	5,631,473	2,588,668	54.0
81-90	5,597,684	2,498,852	55.4
91-100	5,601,987	2,437,254	56.5

Table 10.5. Percentage Change in Modeled P Loads Relative to Modeled P Between 1997-2006 at Illinois River Gauging Locations for Continued Waste Application and Moratorium on Waste Application. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

	Illinois River at Tahlequah		**Baron Fork**		**Caney Creek**	
Year	P Continue Waste (%)	P Stop Waste (%)	P Continue Waste (%)	P Stop Waste (%)	P Continue Waste (%)	P Stop Waste (%)
1-10	6.8	-12.5	4.2	-7.7	12.1	10.1
11-20	19.9	-24.2	27.7	1.6	23.3	17.0
21-30	23.7	-31.8	28.7	-5.4	17.3	9.8
31-40	21.8	-38.4	20.9	-13.9	10.1	2.2
41-50	22.1	-43.1	21.7	-17.7	3.9	-4.6
51-60	20.1	-47.0	16.8	-21.6	-2.8	-11.5
61-70	19.7	-50.2	16.9	-23.9	-11.2	-20.5
71-80	18.6	-52.7	14.0	-27.6	-22.0	-31.3
81-90	18.7	-53.9	11.5	-30.5	-28.7	-38.2
91-100	19.2	-54.9	11.0	-32.0	-33.6	-43.5

Table 10.6. Percentage Change in Modeled P Loads Relative to Observed P Between 1997-2006 at Illinois River Gauging Locations for Continued Waste Application and Cessation of Waste Application. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

	Illinois River at Tahlequah		**Baron Fork**		**Caney Creek**	
Year	P – Continued Waste (%)	P – Waste Cessation (%)	P – Continued Waste (%)	P – Waste Cessation (%)	P – Continued Waste (%)	P – Waste Cessation (%)
1-10	7.0	-12.4	-12.8	-22.8	8.8	6.9
11-20	20.1	-24.0	6.9	-14.9	19.7	13.6
21-30	23.9	-31.6	7.8	-20.8	13.9	6.6
31-40	22.1	-38.3	1.2	-27.9	6.9	-0.8
41-50	22.3	-42.9	1.9	-31.1	0.9	-7.3
51-60	20.4	-46.9	-2.2	-34.4	-5.6	-14.1
61-70	19.9	-50.1	-2.1	-36.3	-13.8	-22.8
71-80	18.8	-52.6	-4.6	-39.4	-24.2	-33.3
81-90	19.0	-53.8	-6.7	-41.8	-30.7	-40.0
91-100	19.5	-54.8	-7.1	-43.0	-35.5	-45.2

For continued poultry waste application, the P loads at Tahlequah increase slightly for the first 30 years before stabilizing and declining slightly in subsequent years. Thus, the trend line for P loads at Tahlequah is flat. The P load results for continued poultry waste application for the Baron Fork location are similar to those at Tahlequah. The Baron Fork and Tahlequah results indicate the IRW soils in these watersheds have reached their capacity to retain additional P and thus expected P losses increase slightly over time before stabilizing and decreasing slightly. The P loads from these watersheds has reached steady state for current poultry waste land application. Note however, that tremendous variability in P loads from year to year exists due to variability in rainfall and flows in IRW streams and rivers.

The P loads for Caney Creek for continued poultry waste application decline due to the small amount of poultry waste applied in this watershed and the low STP values for soils in this watershed. More P is removed from this watershed than is applied with the poultry waste.

The P loads at Tahlequah and Baron Fork near Eldon would likely be greater than modeled loads under the continued poultry waste application scenario. The historical flows from 1950 through 2007 in the IRW were greater than flows for 1997 to 2006 (the period used for modeling the future). P loads to Tenkiller are strongly correlated with flow (Vieux and Moreda, 2003). Thus, if the weather for 1950 through 2007 repeats in the future, the P loads into Lake Tenkiller would be greater than modeled loads using 1997 through 2006 weather and flow data.

The P loads and trends for cessation of poultry waste application are shown in Figures 10.2-10.7 and Tables 10.2-10.6.

The P loads decrease by more than 16% in the first 10 years for IRW poultry waste application cessation compared to continued poultry waste application (Table 10.4 and Figure 10.8). The results indicate that poultry waste land application cessation within the IRW would provide some benefit (16% reduction in P loads to Lake Tenkiller). However, more than 70 years would be required for the P loads to be reduced to 50% of their current levels. This is due to the significant amount of P stored in the soils within the IRW as indicated by STP levels and the IRW P mass balance described in Appendix B. The large amount of P from land application of poultry waste continues to contribute to P loads reaching Tenkiller at substantial levels into the future. Even at 100 years, the accumulated P from poultry waste application continues to significantly contribute to P loads.

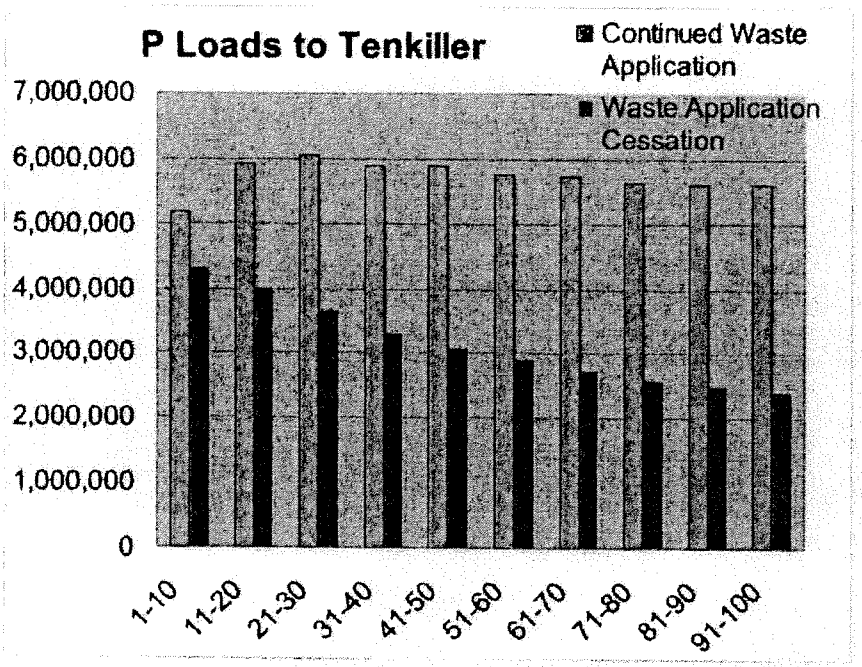

Figure 10.8. P Loads to Lake Tenkiller for Continued Waste Application in the IRW. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

10.3 P Loads for Increased Poultry Waste Application

For continued growth in the IRW poultry industry at a rate the same as that between 1982 and 2002, P loads to Lake Tenkiller would increase substantially. Within 40-50 years, P loads to Lake Tenkiller would nearly double (increase of 92%).

Figures 10.9-10.14 show P loads at each of the three gauging stations (Tahlequah, Baron Fork at Eldon and Caney Creek) for continued growth in IRW poultry based on the same rate of growth between 1982 and 2002 based on the USDA Agricultural Census poultry data. Figures 10.15 and 10.16 show P loads to Lake Tenkiller for this same situation. Based on this rate of growth assumption, P loads to Lake Tenkiller through the Tahlequah location would increase substantially (double in 40-50 years) as a result of increased poultry waste application in this watershed. P load changes at the Baron Fork location would increase a smaller amount (60% in 40-50 years) due to less poultry waste being applied in this watershed. P loads at the Caney Creek location would decrease slightly over time (50 years) in this scenario (but less than no changes in poultry production) due to the small amount of poultry waste applied in this watershed and the low STP levels.

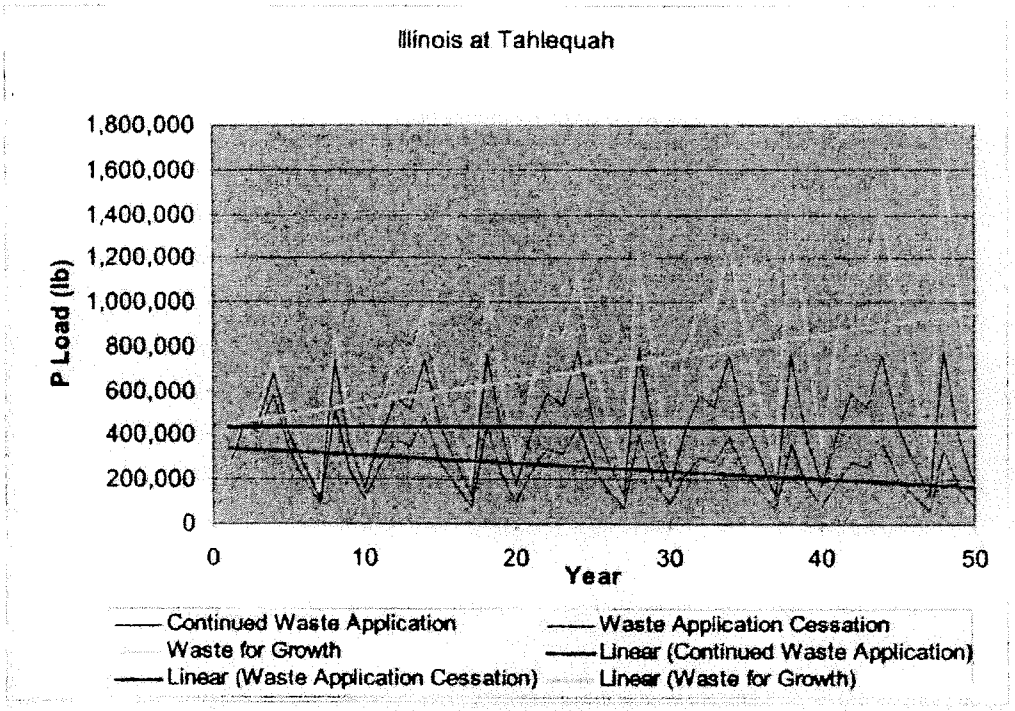

Figure 10.9. P Loading and Trend Lines at Tahlequah for Continued Waste Application, Waste Application Cessation, and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

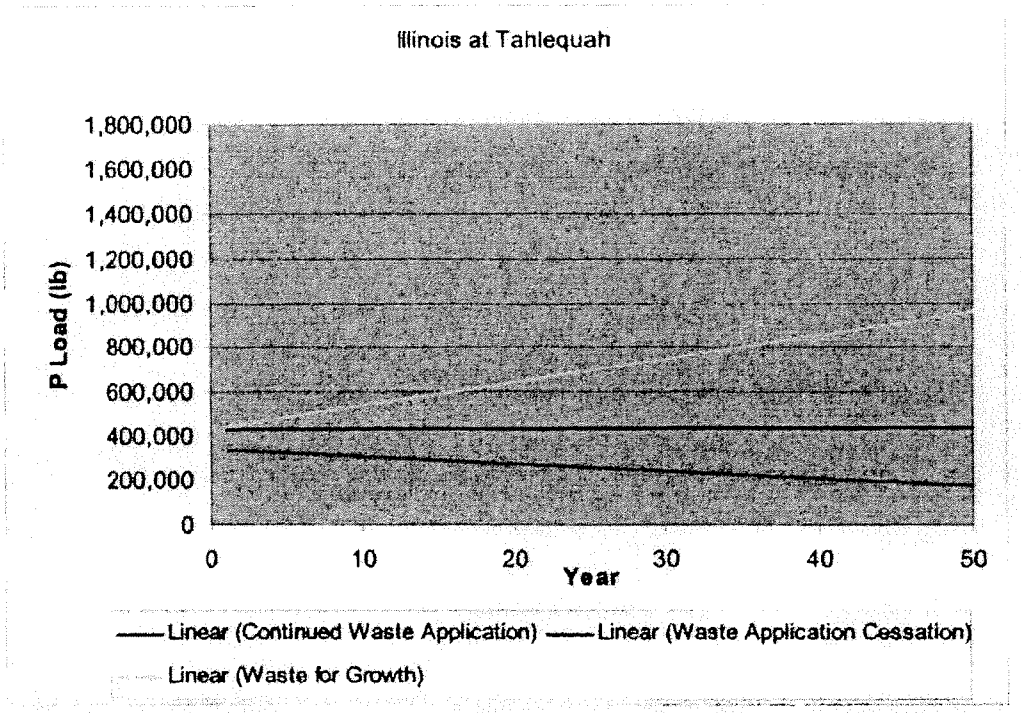

Figure 10.10. P Loading Trend Lines at Tahlequah for Continued Waste Application, Waste Application Cessation, and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

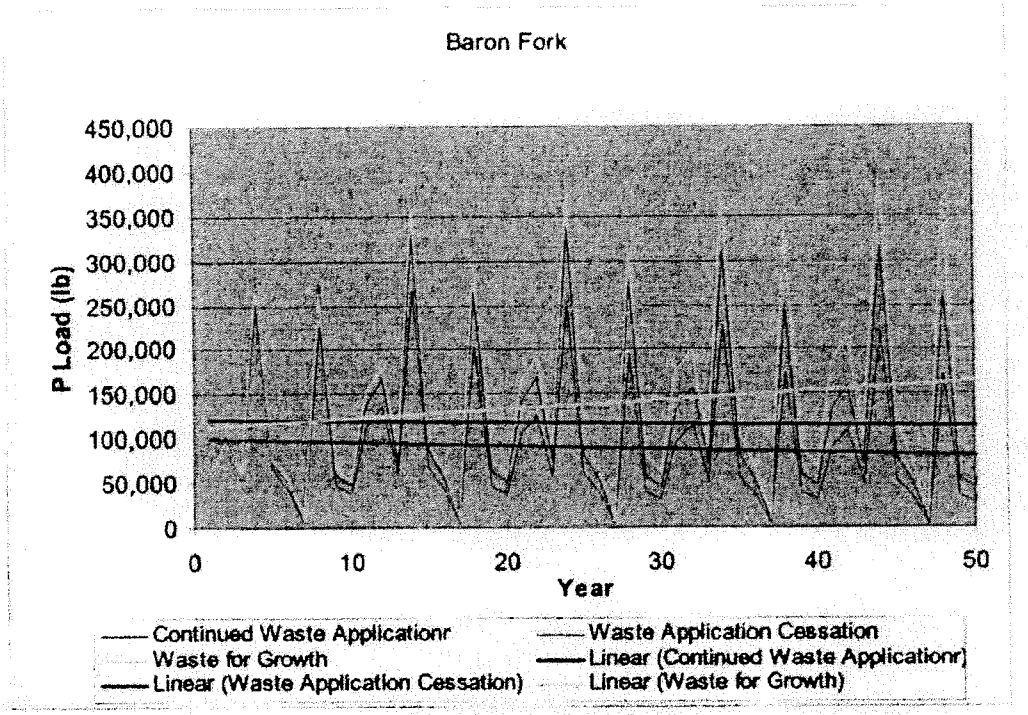

Figure 10.11. P Load and Trend Lines at Baron Fork near Eldon for Continued Waste Application, Waste Application Cessation, and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

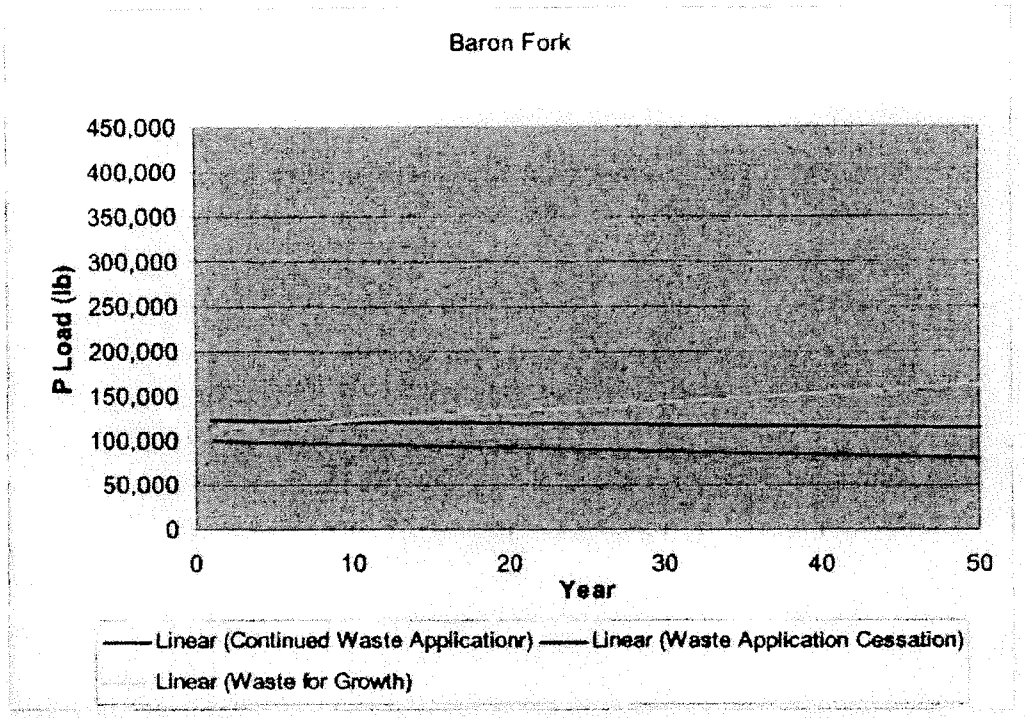

Figure 10.12. P Load Trend Lines at Baron Fork near Eldon for Continued Waste Application, Waste Application Cessation, and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

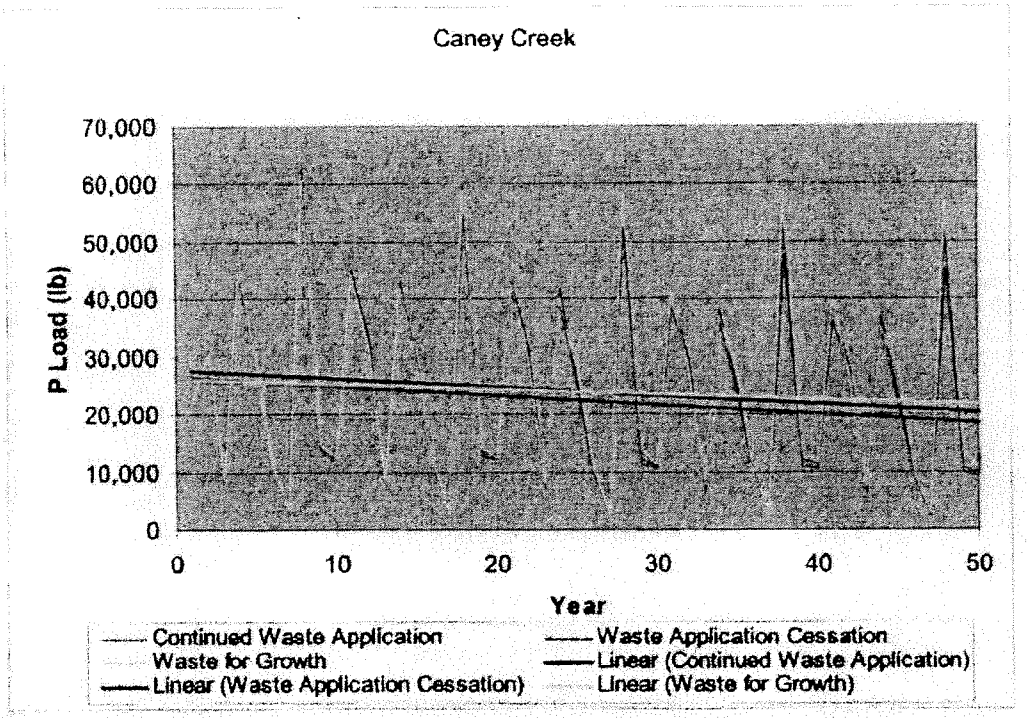

Figure 10.13. P Load and Trend Lines at Caney Creek for Continued Waste Application, Waste Application Cessation and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

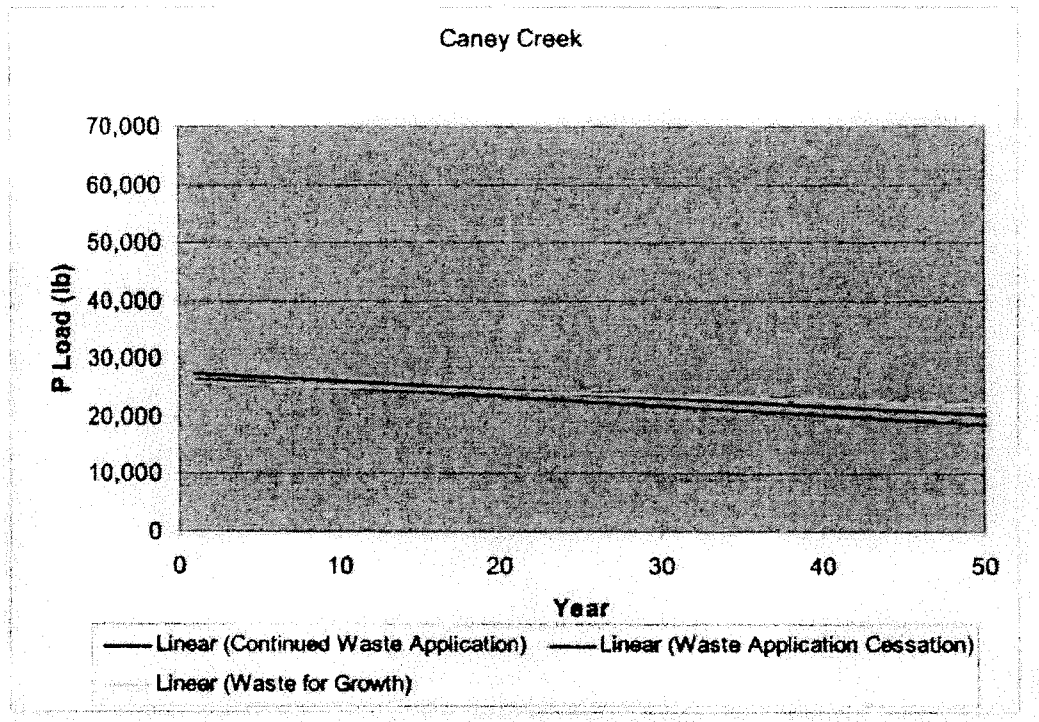

Figure 10.14. P Load Trend Lines at Caney Creek for Continued Waste Application, Waste Application Cessation and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

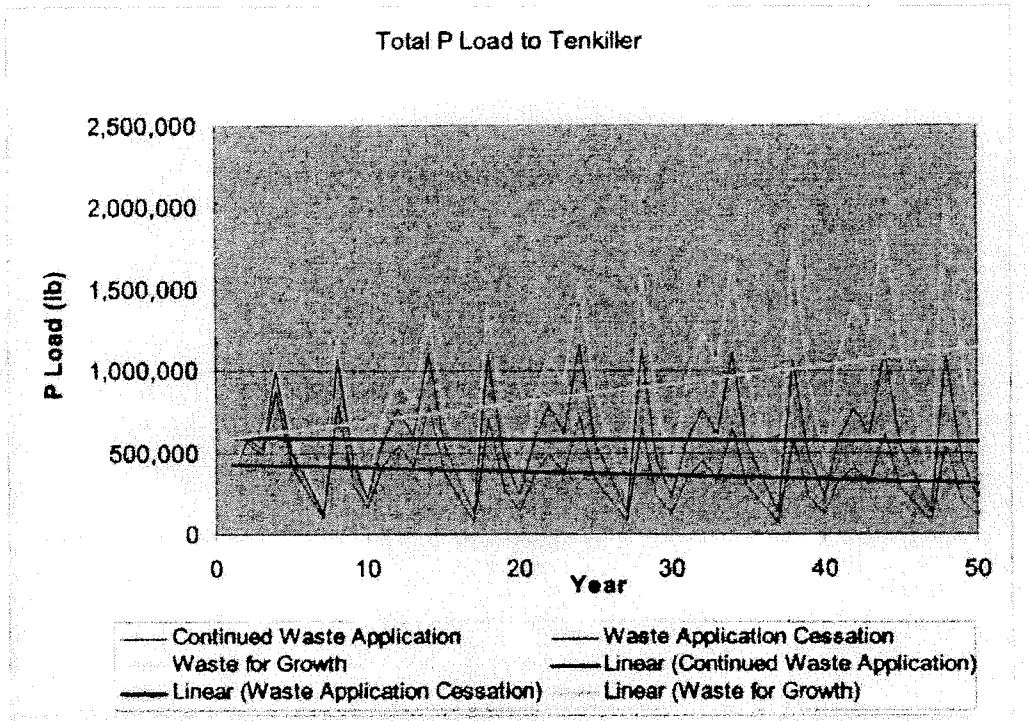

Figure 10.15. P Load and Trend Lines to Lake Tenkiller for Continued Waste Application, Waste Application Cessation and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

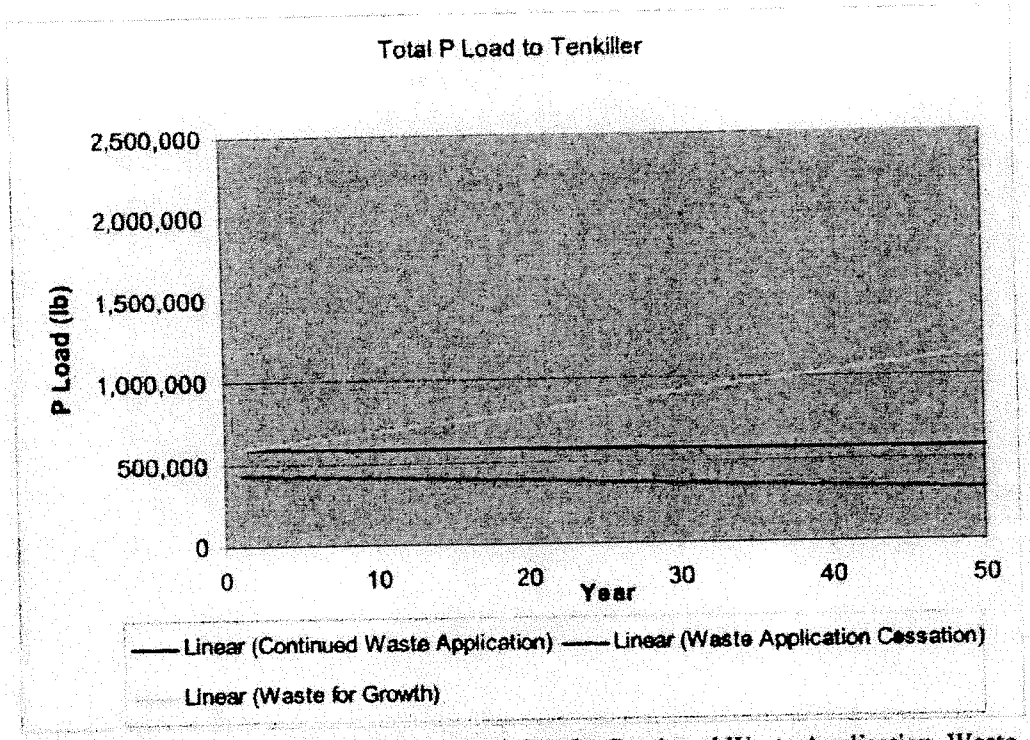

Figure 10.16. P Load Trend Lines to Lake Tenkiller for Continued Waste Application, Waste Application Cessation and Growth in Waste Application Modeled after Poultry Growth in IRW between 1982 and 2002 Based on Ag Census Data

Table 10.7 shows individual main stream and total P loads to Lake Tenkiller for the poultry growth scenario compared to current poultry production and waste application P loads. Growth in the poultry industry in the IRW and the associated land application of this waste in the IRW would result in greatly increased P loads to Lake Tenkiller that nearly double in the 40-50 year time frame.

Table 10.7. P Loads for Growth in IRW Poultry Compared to P Load for Poultry Waste Applied to IRW at Current Rates. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

	P Load (lb) for Growth in Poultry in IRW				**P Load (lb)**	
Years	Tahlequah	Baron Fork	Caney	Total	Total Continued Waste	Increase (%)
1-10	4,523,331	1,010,394	235,614	5,769,339	5,174,495	11.5
11-20	6,066,771	1,364,064	252,099	7,682,934	5,907,583	30.1
21-30	7,112,706	1,439,913	243,753	8,796,372	6,045,143	45.5
31-40	8,144,070	1,512,312	235,329	9,891,711	5,884,935	68.1
41-50	9,464,415	1,635,132	228,607	11,328,153	5,890,267	92.3

10.4 P Loads for Buffers and Poultry Waste Land Application Cessation

The addition of vegetated 100 foot buffers along all 3rd order and larger IRW streams combined with poultry waste application cessation in the IRW would provide further reductions of P loads of between 3 and 5% compared to poultry waste application cessation alone. The addition of vegetated 100 foot buffers along all IRW streams combined with poultry waste application cessation in the IRW would provide further reductions of P loads of between 10 and 13% compared to poultry waste application cessation alone.

P loads were calculated for three locations entering Lake Tenkiller (Tahlequah, Baron Fork at Eldon, and Caney Creek) for combined poultry waste land application cessation and 100 foot buffers placed along 3rd order and larger streams and rivers with adjacent pasture. The P loads for each of these locations are shown in Figures 10.17-10.22. The buffers would provide a modest 4-5% additional reduction (see Table 10.8 and Figure 10.23) in P loads to Lake Tenkiller relative to land application of poultry waste cessation alone as depicted in Figures 10.17-10.23.

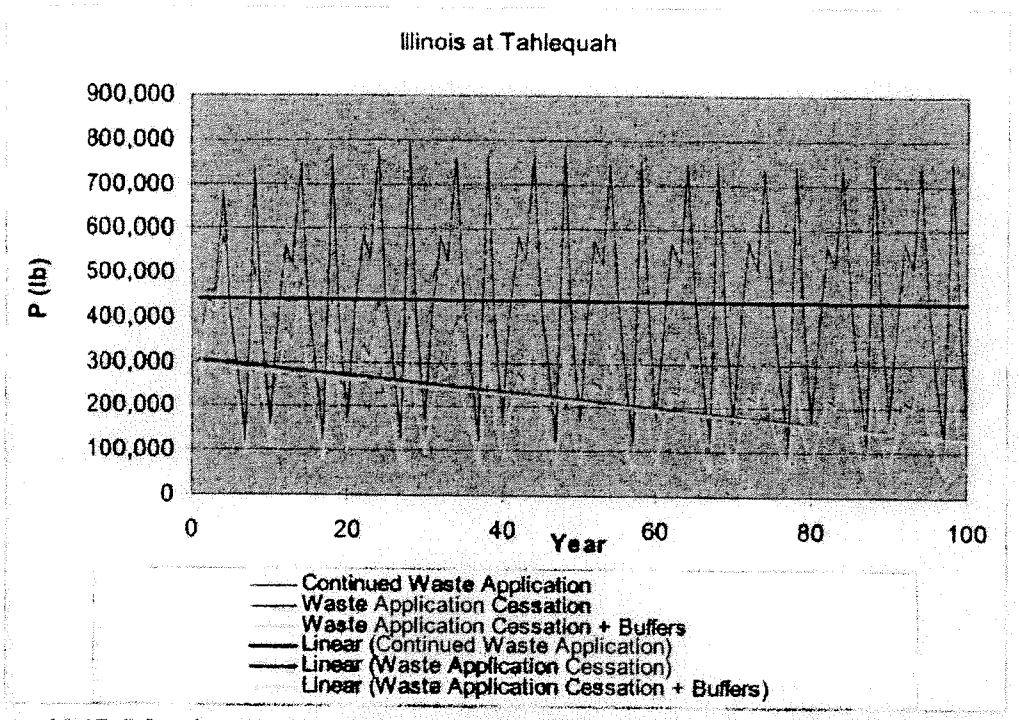

Figure 10.17. P Loads at Tahlequah for the Combination of Buffers Along Third Order and Larger Streams and Rivers and Poultry Waste Land Application Cessation in the IRW.

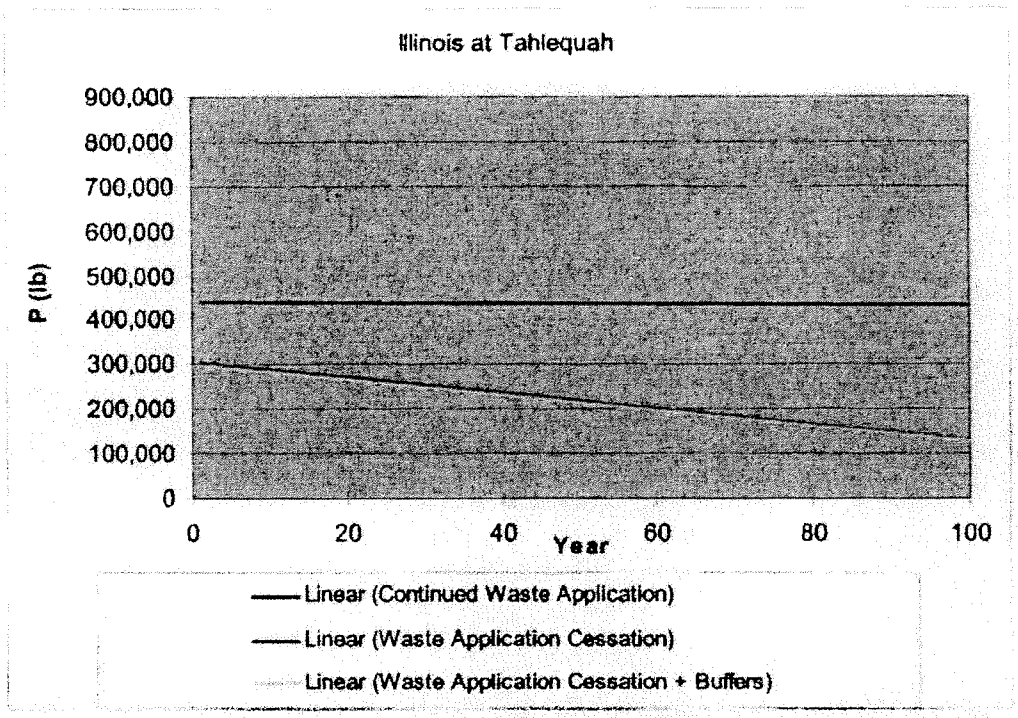

Figure 10.18. P Load Trend Lines at Tahlequah for the Combination of Buffers Along Third Order and Larger Streams and Rivers and Poultry Waste Land Application Cessation in the IRW.

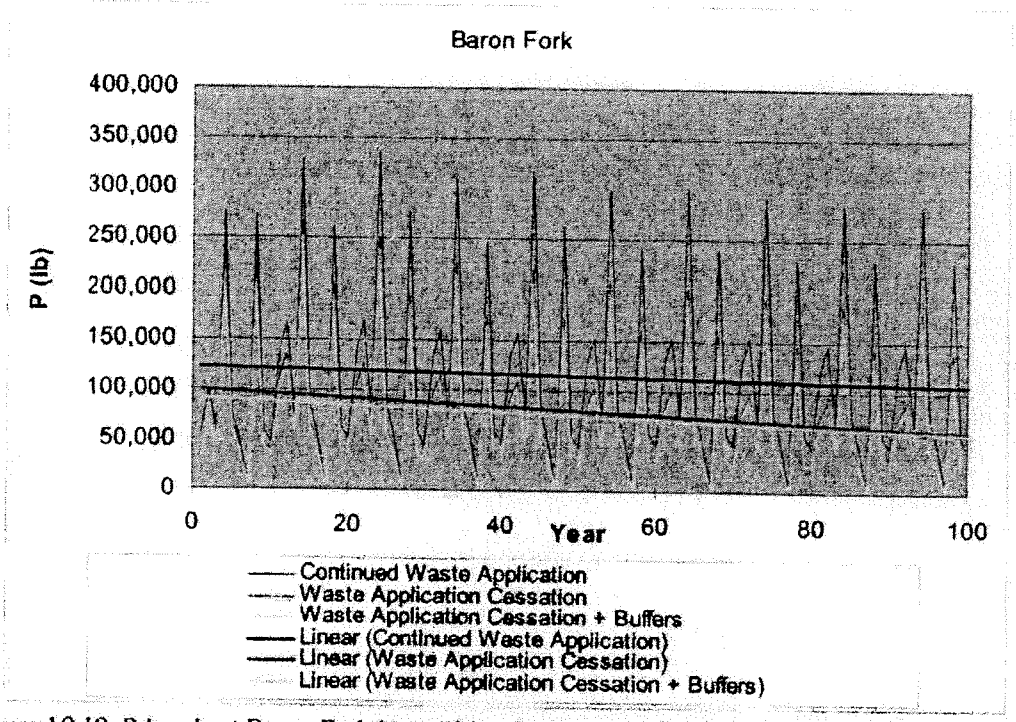

Figure 10.19. P Loads at Baron Fork Near Eldon for the Combination of Buffers Along Third Order and Larger Streams and Rivers and Poultry Waste Land Application Cessation in the IRW.

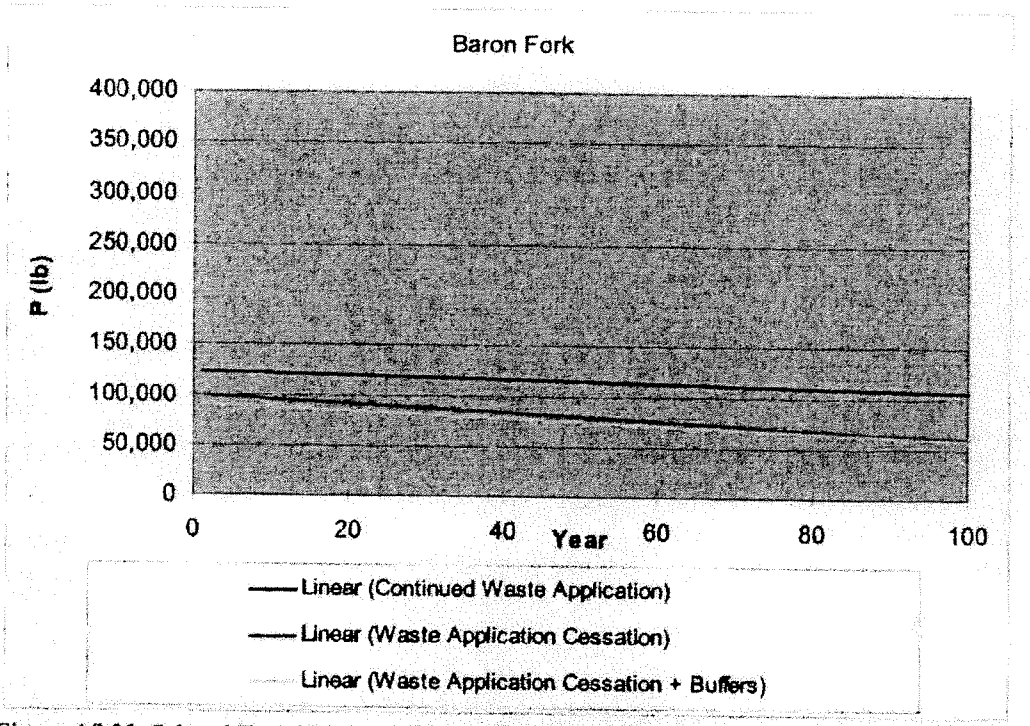

Figure 10.20. P Load Trend Lines at Baron Fork Near Eldon for the Combination of Buffers Along Third Order and Larger Streams and Rivers and Poultry Waste Land Application Cessation in the IRW.

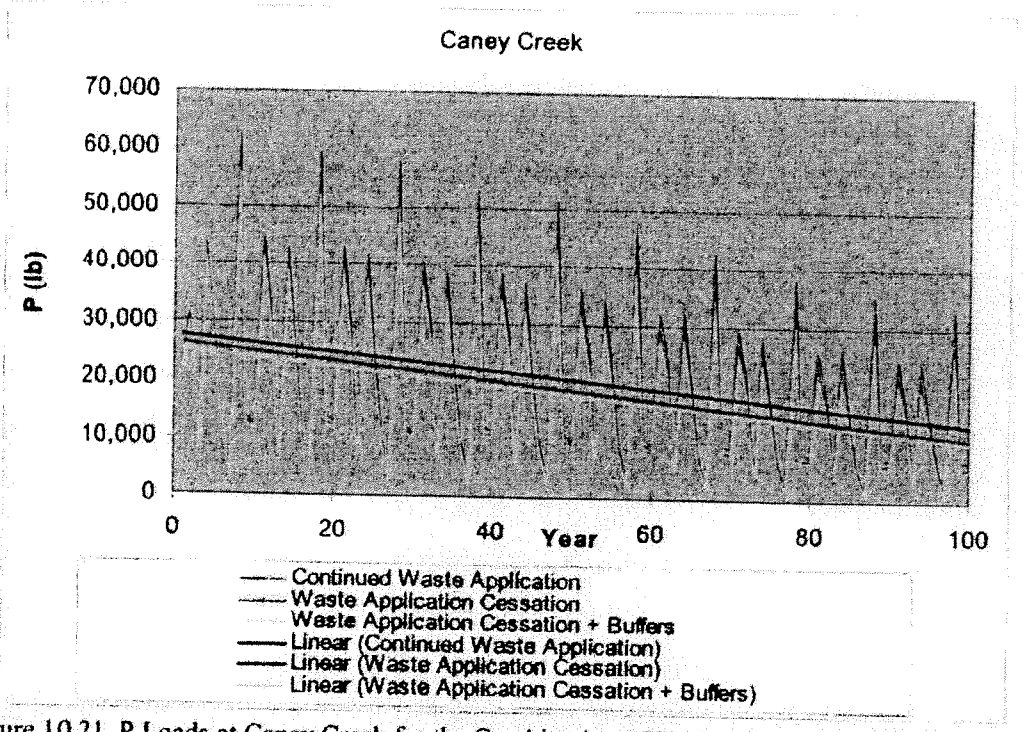

Figure 10.21. P Loads at Caney Creek for the Combination of Buffers Along Third Order and Larger Streams and Rivers and Poultry Waste Land Application Cessation in the IRW.

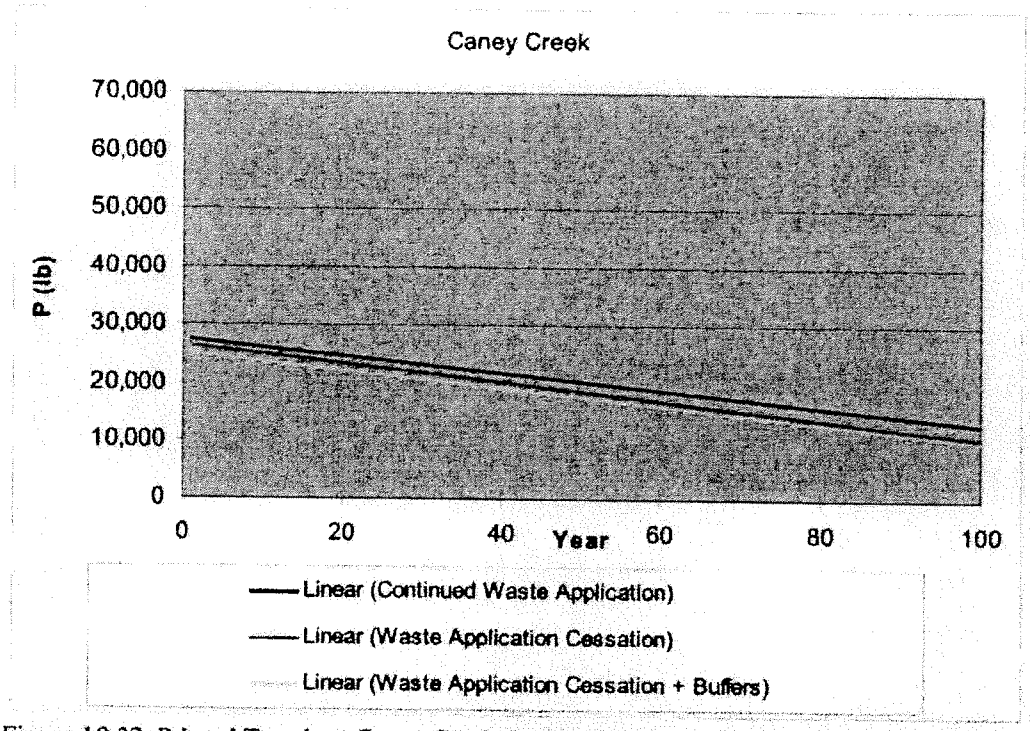

Figure 10.22. P Load Trends at Caney Creek for the Combination of Buffers Along Third Order and Larger Streams and Rivers and Poultry Waste Land Application Cessation in the IRW.

Table 10.8. P Loads for Poultry Waste Cessation and Poultry Waste Cessation Combined with Buffers Along Third Order and Larger Streams in the IRW. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

	P Loads (lbs)					
Years	Tahlequah	Baron	Caney	Total	Total (Cessation Only)	Buffer Reduction (%)
1-10	3,133,605	757,634	218,815	4,110,054	4,343,485	5.4
11-20	2,689,217	933,909	231,133	3,854,259	4,019,937	4.1
21-30	2,423,927	873,672	216,971	3,514,570	3,658,654	3.9
31-40	2,191,768	795,600	202,047	3,189,414	3,315,579	3.8
41-50	2,030,388	760,109	188,671	2,979,167	3,093,820	3.7
51-60	1,891,768	724,197	175,071	2,791,037	2,895,368	3.6
61-70	1,780,790	703,274	157,327	2,641,391	2,737,468	3.5
71-80	1,695,237	669,183	136,005	2,500,425	2,588,668	3.4
81-90	1,650,338	642,659	122,352	2,415,349	2,498,852	3.3
91-100	1,616,287	628,752	111,958	2,356,997	2,437,254	3.3

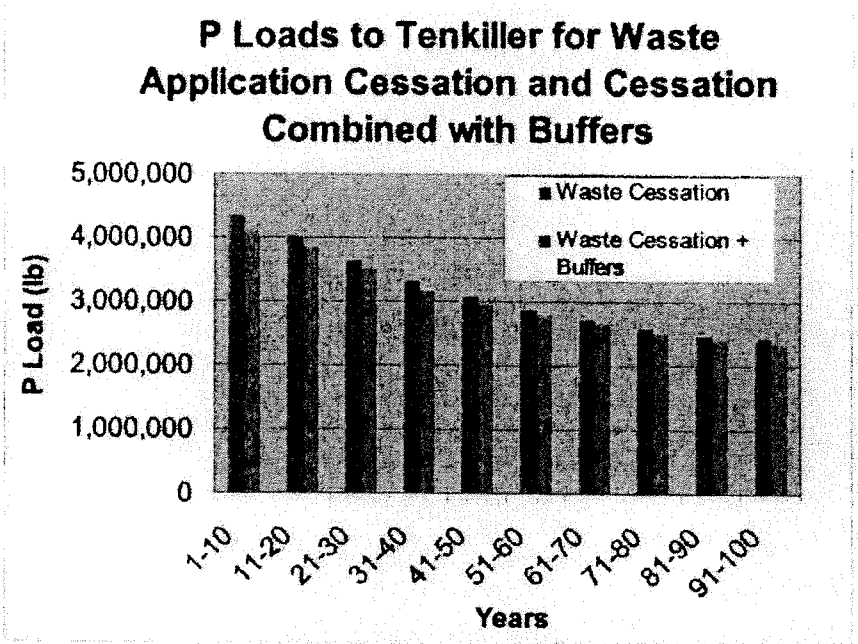

Figure 10.23. P Loads to Lake Tenkiller for Poultry Waste Application Cessation and Cessation Combined with Buffers Along Third Order Streams with Pastures. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

P loads were computed at three locations entering Lake Tenkiller (Tahlequah, Baron Fork at Eldon, and Caney Creek) for combined poultry waste land application cessation and 100 foot buffers placed along *all streams and rivers* with adjacent pasture (Figure 10.24 and Table 10.9). The buffers would provide approximately 10-13% additional reduction in P loads beyond cessation of poultry waste application in the IRW (Table 10.9).

Table 10.9. P Loads for Poultry Waste Cessation and Poultry Waste Cessation Combined with Buffers Along *All Streams* with Pasture in the IRW. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.

	P Load (lbs)					
Years	Tahlequah	Baron	Caney	Total	Total (Cessation Only)	Buffer Reduction (%)
1-10	2,950,892	681,686	192,838	3,825,416	4,343,485	11.9
11-20	2,472,310	826,213	200,674	3,499,198	4,019,937	13
21-30	2,235,679	772,673	188,473	3,196,825	3,658,654	12.6
31-40	2,031,210	703,927	175,631	2,910,769	3,315,579	12.2
41-50	1,889,161	672,674	164,107	2,725,943	3,093,820	11.9
51-60	1,767,155	641,064	152,402	2,560,620	2,895,368	11.6
61-70	1,669,441	622,649	137,128	2,429,217	2,737,468	11.3
71-80	1,594,166	592,629	118,763	2,305,558	2,588,668	10.9
81-90	1,554,654	569,287	107,015	2,230,956	2,498,852	10.7
91-100	1,524,670	557,038	98,060	2,179,768	2,437,254	10.6

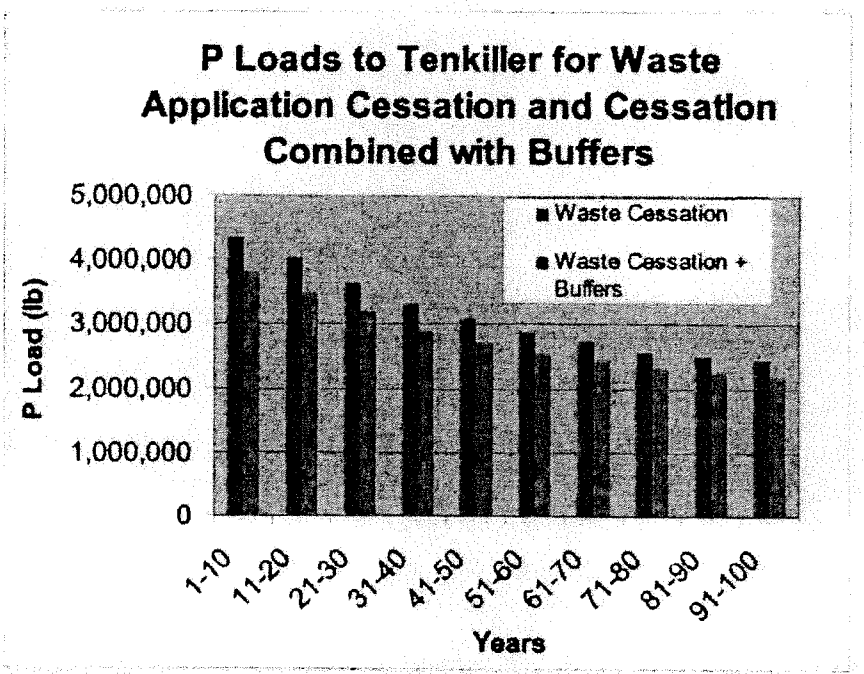

Figure 10.24. P Loads to Lake Tenkiller for Poultry Waste Application Cessation and Cessation Combined with Buffers Along *All Streams* with Pastures. Weather Repeats Every 10 Years So Results Are Summarized in 10 Year Periods.